Using Reproductive Records: Basics of Monitoring

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The dairy industry is very dynamic and has undergone tremendous change in the last few decades. During the 1940's and 1950's, industry leaders were touting the benefits of using purebred dairy bulls to increase milk production through genetic selection; agronomists were promoting the concept of managing soil fertility, specifically nitrogen, for better crop yields; and refrigeration and transportation technologies were improving, leading to improved dairy product acceptance and consumption by the consumer.

Today's dairy environment is dramatically different from the 1950's. Producers now have access to genetically engineered crops, computerization to aid with crop planting, cattle feeding, and milk harvest, and new biotechnology tools to enhance milk production. Instead of simply relying on a purebred natural service sire, producers now have their choice of a variety of timed AI protocols, sexed semen, and in vitro fertilization followed by embryo transfer. During this period of rapid change, milk production in the U.S. has improved from approximately 5000 lbs/ cow in 1950 to over 18,000 lbs in 2000 based on estimates from the United States Department of Agriculture (http://www.nass.usda.gov). Continued improvement in milk production efficiency has enabled the modern dairyman to remain profitable despite receiving milk prices that are not much different from 20 years ago.

Despite the vast improvements in milk production, management and overall production efficiency, one principle that has remained constant is that reproductive efficiency has a large effect on overall dairy herd profitability. Sound reproductive management benefits dairies by increasing milk production (more rapid return to more profitable and efficient phase of lactation), more culling options due to fewer late lactation removals of non-pregnant cows, more replacement heifers and bull calves produced, fewer extended dry periods, and more rapid improvement in genetic gain.

The majority of people working within the dairy industry agree that sound reproductive management can have tremendous positive effects on profitability and one of the key components of modern dairy production medicine is the analysis of reproductive records. Accurate and reliable on-farm records can help guide producers, veterinarians, and consultants to make better management decisions regarding reproductive management. The majority of cows in the US dairy herd are managed using some form of computerized records system such as DairyComp 305, PCDart, and DHIPlus. Carefully maintained and accurate records that can be analyzed appropriately can help answer questions such as: 1) Where are we now regarding pregnancy production? 2) How have we performed historically? and 3) Where are we headed in the near future?

However, before getting into specific monitors, reports or interpretation, there are some general concepts, concerns and terminology that must be considered. These critical issues have been previously discussed in more detail in previous publications regarding dairy herd monitoring and readers desiring more detailed information should consult these references.[1-4]

Terminology:

Voluntary waiting period: The period of time set aside after calving that allows for uterine involution and hopefully, the resumption of cyclicity, prior to the initiation of breeding. For most dairies, the VWP is 45-60 days in milk.

Conception risk: The percent of services with known outcomes over a specified period of time that result in a pregnancy, or, alternatively, the number pregnant divided by number inseminated (and subsequently determined to be pregnant or not pregnant) over some time period.

Insemination risk: The percent of eligible cows that are inseminated within a given time frame – usually 21 days. This estimate includes animals inseminated as a result of estrus detection or by timed insemination. This estimate is usually not performed for bull breeding since few are actually recording which cows are actually serviced by the bull.

Pregnancy rate: The percentage of eligible cows that becomes pregnant within a given time frame - usually 21 days. While it is true that heat detection (or insemination risk) and conception risk dramatically impact pregnancy rate, they should not be the basis for calculating pregnancy rate. Hence, pregnancy rate can be calculated for bull pens similarly to AI pens once the entry date into the pen and the conception dates are estimated.

Comments Regarding Setting Goals

Goals:

Goals are target levels of performance toward which producers are trying to achieve. When setting goals, one should follow the S.M.A.R.T. approach and define goals that are specific, measurable, attainable, realistic, and timely. An important concept here is to not set goals that are too lofty and unrealistic. Dairymen should not set 30% as their pregnancy rate goal, at least not initially, if their herd is currently languishing at 12% pregnancy rate. Instead, they should pick a more reasonable improvement level, work to achieve that level of performance, celebrate that accomplishment, and then set a new higher goal. For example, if a dairy herd is currently sitting at a 17% pregnancy rate for the whole herd and is utilizing AI with sporadic use of synchronization protocols and clean-up bulls, one potential goal for reproductive performance may be a 20% pregnancy rate for the herd within the next 9 months by more careful and consistent utilization of timed AI protocols, improved semen handling skills, increased estrus detection efficiency and reduced reliance on natural service sires.

Once goals have been set, one must define the individual components or processes that impact the dairy's ability to reach the previously defined targets and determine how performance will be evaluated. In order to achieve a high pregnancy rate, there are a multitude of processes that must all function properly. Cows must transition well from dry cow to fresh cow with limited negative impact from negative energy balance, metritis, endometritis, etc.; cows must receive their first insemination in a timely manner following the end of the voluntary waiting period and be efficiently reinseminated if pregnancy does not occur; good semen handling and breeding skills should result in a high risk of conception for each insemination; and once pregnancies are created, there should be low risk of embryonic loss or abortion. Each of these aforementioned areas could be described as monitoring parameters, i.e., each one is a measurable factor that contributes to the overall reproduction efficiency goal of a higher pregnancy rate.

Benchmarks:

Benchmarks are standards by which others can be measured or compared. Benchmarks are not synonymous with goals. Instead, benchmarks are reported standards that are typically adapted from large data sets. Often, these benchmarks are simply the averages for different monitoring parameters and may be derived by lumping together herds that represent a wide variety of production levels and management philosophies. Unfortunately, many people may use these benchmarks as herd-level goals. These benchmarks become measuring sticks to evaluate their own dairy's performance. Commonly used benchmarks that producers use to evaluate herd reproductive status often include the use of calving interval, average days open, and pregnancy rate. For example, whole herd pregnancy rates typically average about 14% across the U.S. A producer that is currently at 16% pregnancy rate might feel good about his herd's performance as compared to the benchmark of 14%, but based on economic modeling, he is incurring tremendous lost opportunity costs by his inability to achieve a more profitable, yet realistic, level of reproductive efficiency of 20-25%.[5] In the absence of other data, benchmarks can be useful as a starting point for comparison, but who wants to strive to be just average in an economic sense? As a general rule, generic, industry-wide benchmarks are dangerous, and should be avoided, or at the very least, used with extreme caution. A far better approach would be to evaluate their current status, and see if recent changes were harmful or beneficial. Ultimately, producers should set their own herd-specific goals.

Monitoring Issues

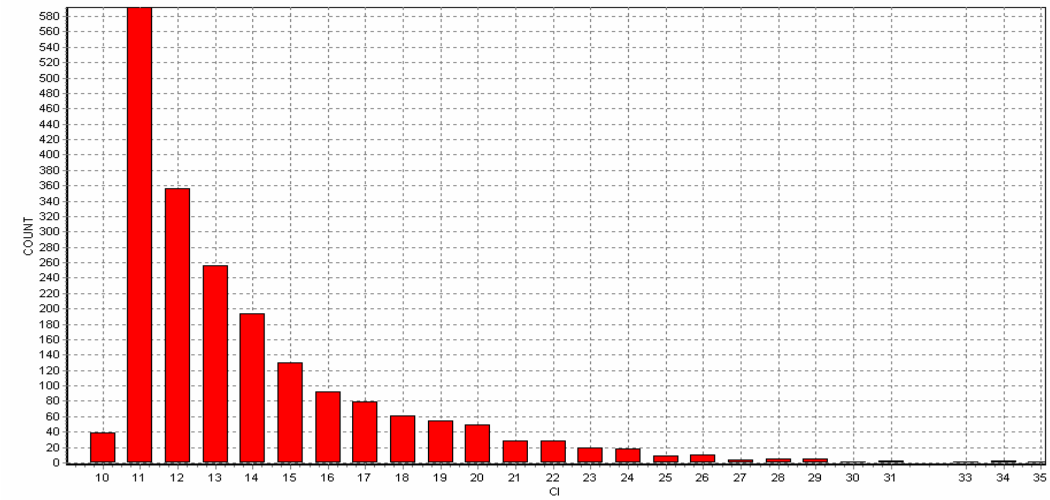
The process of monitoring involves the routine and systematic collection and evaluation of information (monitoring parameters) from a dairy in an attempt to detect change in the process. In general, monitoring is used to measure the effect of some implemented intervention, to detect the occurrence of an unintended disruption in the system process, and to help motivate behavioral change on the dairy by identifying previously unknown or unrecognized issues. Equally important, however, is to use caution with monitoring to avoid changing something when it is not really a problem.

Of course, mistakes can be made in monitoring performance parameters and there are some clearly identified potential pitfalls that should be recognized by professionals involved with dairy performance monitoring including variation, lag, momentum, and bias. The traditional reproductive parameter of calving interval will be used to illustrate the potential issues with each of these pitfalls, but calving interval can be defined in several different ways. Actual historical calving interval refers to the elapsed time from one calving to the next. Therefore, in order to calculate a calving interval, a cow has to calve, be rebred, conceive, maintain the pregnancy, and calve again. Some data processing centers will report a minimum projected calving interval. This overly optimistic version of the calculation projects forward in time by adding a projected gestation length to a days open value for each cow in the herd that is past the voluntary waiting period. Pregnant cows have an actual days open, while cows that have been inseminated but not yet checked are assumed pregnant to determine their days open. For cows that are past the voluntary waiting period but not yet inseminated, it is assumed that they will conceive during the next 21-day period and adds 10 days to their current days in milk to estimate a minimum days open.

Variation**:**

Variation is a concept referring to the amount of change over time. The different ways of calculating calving interval represents one form of variation across the different processing centers. At the herd level, variation can refer to how much difference there is in an outcome across some population. Averages are often used to measure the central tendency for a group but the amount of spread or variation is not apparent and a few outliers can dramatically skew the average. Again, consider the traditional parameter of actual calving interval. Below in figure 1 is a frequency histogram of the actual historical calving intervals for cows in the herd. This herd is currently running a 15% pregnancy rate and the average calving interval is 14.2 months. However, it is very apparent from looking at the graph that there is a lot of variation in calving interval. In this example, over 50% of the cows have a calving interval of 13 months or less and about 13% have a calving interval of over 18 months.

Figure 1. Frequency histogram of the calving intervals for a 3000 cow dairy.



Lag:

Lag refers to the elapsed time between when an event occurs and when it is measured. Lag is inherent in many reproductive parameters such as conception risk because we must wait until we can actually determine the outcome of the insemination by either a return to estrus or by pregnancy evaluation. However, the lag for conception risk is only about 30 +/- 10 days depending on the method of outcome determination. In comparison, calving interval has a much longer lag period associated with it. In order for a cow to have an actual calving interval recorded, she must calve, be rebred, and then calve again. This results in a lag of 10-20+ months, depending on how quickly she became pregnant. While some may argue that a lower calving interval is a reasonable goal, it is a very poor monitoring parameter for reproductive management.

Momentum:

Momentum refers to the dampening or buffering effect that results from excessive influence of events from the distant past on current performance, i.e., recent changes may be obscured by the weight of historical performance. As a consequence, mistakes may be made in interpretation of performance in either direction. For example, if a herd is using the annual actual calving interval as their reproductive monitor, the herd may not realize that progress is being made reproductively due to the severe dampening effect of months of previous poor performance. Conversely, reproductive efficiency may be declining rapidly, but due to a combination of the severe lag and large impact of momentum, actual calving interval may still look respectable.

Bias:

The final of the four major potential pitfalls regarding interpretation of performance records is bias. A bias is a systematic error in the collection, analysis or interpretation of data that can lead to incorrect conclusions. Or, to put it in more simple terms, bias is the incorrect inclusion or exclusion of cows from the parameter calculation. Again, using calving interval as the source of our example shows a biased estimate of reproductive efficiency for the herd since only cows that have calved twice or more are eligible for consideration. First lactation animals are automatically excluded from consideration and older animals are included, but only after calving again. There is no information regarding animals that failed to become pregnant, failed to maintain a pregnancy, or that were culled from the herd. Excluding subpopulations such as these may make the numbers look better but do not adequately evaluate the herd's true performance.

Bias can also be introduced into the evaluation if cow records are incomplete or if assumptions are made regarding pregnancy outcome. For example, historical pregnancy rates can be biased upwards (yielding an incorrect overestimation of performance) by failing to consider cows that were culled as nonpregnant animals. Also, some DHIA systems still use non-return information for the purposes of calculating reproductive efficiency estimates. Cows with a recorded breeding but no followup pregnancy determination or additional breedings may be assumed pregnant after a specified period of time. In these herds, the apparent pregnancy rate as reported on the DHIA summary sheet may be approximately three times higher than reality.

Evaluating Reproductive Performance

Every dairy consultant has their own approach toward evaluating reproductive performance via dairy herd records. The approach that is presented here is not meant to be all inclusive, nor is it meant to be an "ideal" method, but rather is simply the approach that the author prefers to take when looking at reproductive records on-farm. Illustrations will be made using the DairyComp 305 software package. The following outline represents one potential approach to the evaluation of reproductive performance:

- Understand the herd's objectives regarding its reproductive program
- Verify completeness of the available data
- Evaluate the "true" VWP and the herd's ability to deliver semen in a timely manner for first insemination
- Evaluate the pregnancy rate, ideally from a variety of ways:
    - Whole herd performance over the last year
        - By calendar date
        - By days in milk
    - AI herd vs. natural service (if bulls are used)
    - First lactation vs. 2+ lactation cows
- Evaluate breeding submission risk using the previous approach (except for bulls)
- Evaluate conception risk
    - Service number, breeding type or code, technician, day of the week, and via a stratified approach if cow numbers allow
- Pregnancy check evaluation – frequency, compliance
- Pregnancy hard count
- Pregnancy losses

- Transition health and management (if data is available)

The first step mentioned in the outline (evaluate the herd's objectives) sounds a bit like an academic issue, but is critical in order to understand the herd's goals, expectations, and willingness to work to improve. For example, some herds want to have the highest possible pregnancy rate and are willing to do whatever it takes to achieve it while other herds don't want to do anything more than deliver 1-2 AI services prior to dumping cows into bull pens. These latter herds do not want to be bothered with the intricacies of managing a timed AI program or investing additional management time or resources towards YOUR reproductive goal for THEIR dairy. If you try to evaluate and manage them toward a very high level of performance, the result is often a painful lesson learned (and a bloodied forehead from constantly hitting the wall!).

Once it is determined that you and the producer are on the same page in terms of the herd's reproductive performance goals and expectations, the next step is to verify the completeness of the data. Screening data for accuracy and completeness may involve reviewing lists of cows, examining histograms or scattergraphs, or by evaluating summary tables.[6] Some key items to consider: 1) Are there at least 365 days worth of culled cow records available?, 2) Has the recent insemination and pregnancy confirmation information been recorded?, 3) Are AI and bull pens individually and accurately defined?, 4) Are the records under consideration limited to only the herd of interest? (i.e., are we actually looking at 2 herds sharing the same data file?), and 5) Have there been any new cows merged into the database recently?

One way to quickly check to see if culled cows are included in the record set is to run the following command and make sure that the sold/ died rows look reasonable across time and that there are no 0's present in this area: EVENTS\5i011415. Figure 2 shows the result of this command in a herd with complete data while the herd record set for the herd shown in figure 3 is missing the archive data and shows incomplete culling information. Using the data from the herd in figure 3 as is could lead to biased and incorrect conclusions about the reproductive efficiency of that herd.

Figure 2. Calving and culling information using complete archive records.

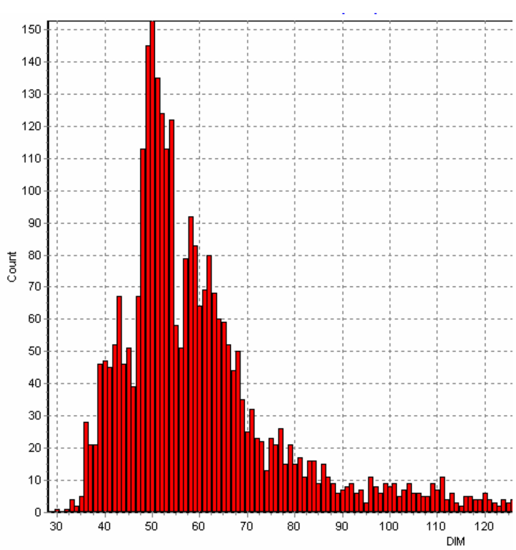
Event	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
FRESH	1913	129	116	141	141	172	155	207	175	173	162	198	144
SOLD	811	81	59	69	62	34	59	50	71	70	140	62	54
DIED	129	12	14	11	4	13	8	17	16	6	14	8	6
TOTALS	2853	222	189	221	207	219	222	274	262	249	316	268	204

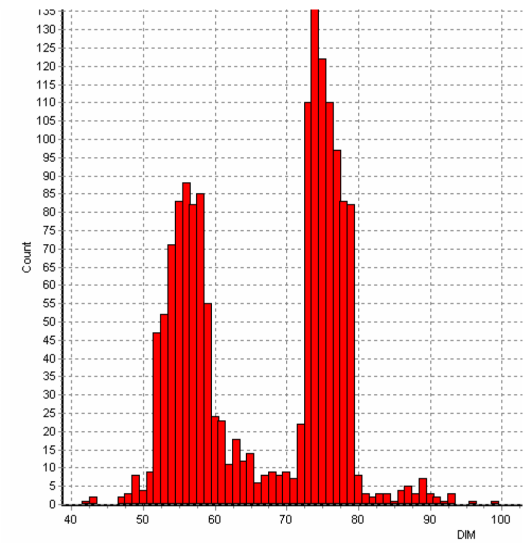
Figure 3. Calving and culling information as reported by incomplete data.

Event	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
FRESH	849	110	63	44	45	60	60	75	46	68	111	84	83
SOLD	69	33	25	0	0	0	0	0	0	0	0	0	11
DIED	7	3	2	0	0	0	0	0	0	0	0	0	2
TOTALS	925	146	90	44	45	60	60	75	46	68	111	84	96

Prior to examining the herd's pregnancy rate, one must determine what the true voluntary waiting period is for the herd in order to know when to start "counting". Many herds will state that their voluntary waiting period is "60 days", but in reality, the records show something entirely different. One approach would be to create either a scatterplot or, as shown below in figures 4 and 5, frequency histogram of days to first insemination.

Figures 4 and 5. Frequency histograms of days in milk at first insemination for two herds (herd "A" and "B") with different voluntary waiting periods and management approaches to first insemination .





Comparing the two figures above, it is clearly evident that herd "A" is breeding cows earlier than the second and herd "B" appears to be utilizing some form of synchronization protocol based on the pattern of first insemination. The true VWP for herd "A" is ~ 40 days (4% of cows have been inseminated by 40 days in milk) while in herd "B", the VWP is ~ 51 days.

As useful as these histograms are, they too have lots of momentum. These graphs show what has happened on average over the past 12-15 months unless a shorter time frame has been requested via the command line. An alternative approach would be to use a scatter graph of DIM at first breeding by calendar date. This will show both the pattern and whether the VWP has changed over time. This command is GRAPH BRED\ST125N1, where 125 represents the upper range for DIM at first insemination.

Once the true VWP has been established, one can then dig deeper to evaluate the efficiency of delivering the first insemination, either by visual assessment of graphs or by calculation using other commands. In AI herds, I like to determine what percent of cows receive an insemination within a specified period of time following the VWP. For example, if a herd is using total timed AI on a weekly basis and a VWP of 70 days, I would like to see 90-95% of cows that are 81 DIM or greater with a first insemination between 70 and 77, excluding reproductive culls and cows starting a lactation by abortion. (For herds using TAI every 2 weeks, the window is expanded to 14 days instead of 7.)

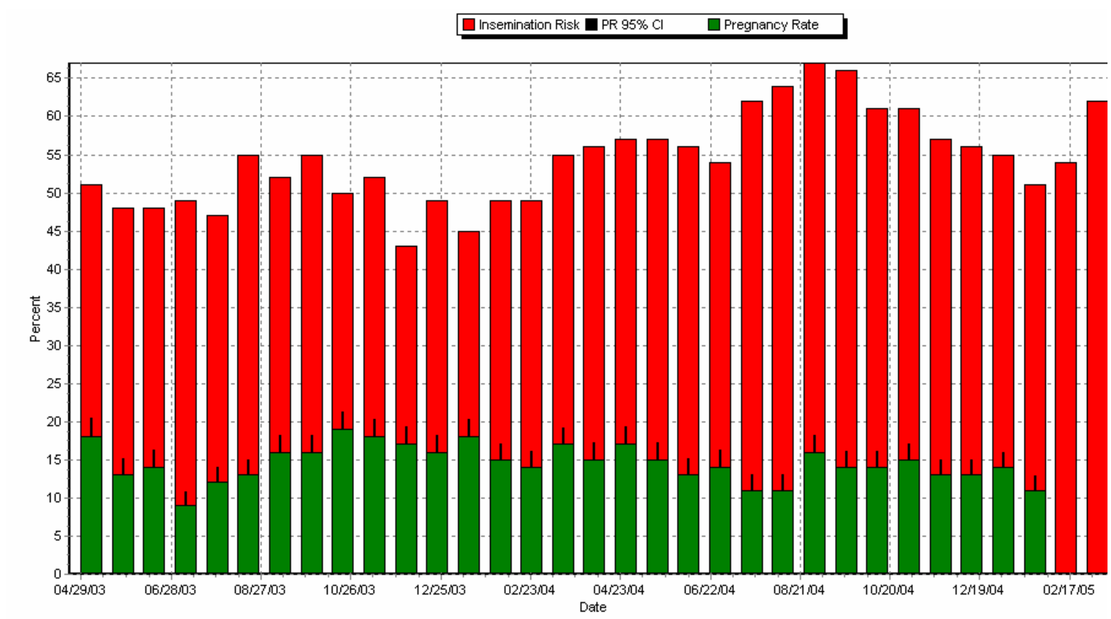
However, most herds do not utilize total TAI and thus expectations must be modified. In the second herd above, a back-door TAI is utilized after breeding off of heats induced by the second prostaglandin in a Presync program on a weekly schedule. The first major band represents cows bred off of standing heat and the second, taller band represents cows receiving the TAI. In between are the cows that either failed to synchronize or were incorrectly inseminated too early. In this situation, I like to see 90-95% of cows inseminated within 30 days of the VWP (51+30=81), excluding "do not breed" cows and cows starting lactation by abortion. My command for this is PCT DIMFB=51-81 FOR FDAT>-400 DIM>81 RC>1 ABDAT=0\L (note: in some DC305 systems, the item for DIM at first insemination, DIMFB, is called BRED1). In this herd's case, it is performing quite well at 93%.

In the first herd, there is no apparent synchronization effort taking place (at least at first glance) and cows are supposedly inseminated based only on heat detection. In this scenario, I like to evaluate first breeding efficiency over 2 21-d cycles. If we assume that all cows are cycling by the end of the VWP (this NEVER happens) and the herd is doing a great job with estrus detection (65% HDR), we could expect at most 88% of cows to be inseminated within 42 days of the VWP. In this herd, the actual number was 82% and it is much higher than anticipated, once an adjustment is made to allow for 20+% not cycling during the first 21-d cycle. (In reality, and unknown to the dairy owner, the breeding technicians were doing a timed insemination off of the second prostaglandin on many cows resulting in higher than anticipated first insemination efficiency and very poor first service conception risk.)

Once the VWP and efficiency for first service has been evaluated, I like to look at the pregnancy rate. While no single monitor is perfect, I feel that pregnancy rate, when performed correctly, is the single best tool for assessing both historical and ongoing reproductive efficiency in a dairy herd. Pregnancy rate is a metric that evaluates the speed at which cows become pregnant and is calculated most commonly on a 21-d basis by dividing the number of cows that became pregnant during that time by the number of cows considered eligible to become pregnant over the same time period. To be considered eligible during that specific 21-day cycle, cows must be past the VWP, not classified as a “do not breed” cow, not already pregnant, and not pending some unknown outcome. Eligibility does not refer to whether she is cycling or not.

I typically start my evaluation of pregnancy rate by calculating the pregnancy rate over the recent past. The default VWP within DC305 is 50 days and since herd “A” has a VWP of only 40 days, we should tell the system to start counting earlier. For this example, the whole herd pregnancy rate can be determined by using the following command: BREDSUM\EAV40D700 (where 40 = VWP and 700 is the amount of time to evaluate). The results of this command for herd “A” are shown in figures 6 and 7.

Figure 6. Graphical presentation of the historical pregnancy rate and breeding insemination risk for a 700 day period for herd “A”.



Date	Br Elig	Bred	Pct	Pg Elig	Preg	Pct	Aborts
5/06/03	990	505	51	981	178	18	16
5/27/03	927	443	48	914	120	13	10
6/17/03	935	450	48	928	128	14	12
7/08/03	941	461	49	925	79	9	9
7/29/03	1023	476	47	1009	124	12	9
8/19/03	1108	609	55	1090	138	13	22
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
8/10/04	975	625	64	959	101	11	18
8/31/04	1052	702	67	1018	158	16	30
9/21/04	1040	691	66	1001	143	14	21
10/12/2004	1066	648	61	1041	149	14	21
11/2/2004	1086	659	61	1070	158	15	13
11/23/2004	1108	635	57	1097	145	13	10
12/14/2004	1160	648	56	1139	148	13	9
1/04/05	1175	643	55	1157	157	14	2
1/25/05	1190	607	51	1147	125	11	1
2/15/05	1256	675	54	0	0	0	0
3/08/05	1051	651	62	0	0	0	0
Total	32670	7647	**54**	32147	4688	**15**	535

Figure 7. Table format for historical pregnancy rate and breeding insemination risk for a 700-day period for herd “A”. (Note: ~ 1 year’s worth of data has been omitted to conserve space.)

This combination of current and historical data illustrates where the herd has been reproductively, where it is currently, and also gives us some indication of what to expect in the near term. One can see that during late summer, 2004, breeding submission risk climbed dramatically, but pregnancy rate did not improve. This is most likely the period of time when the breeders began the timed inseminations off of the prostaglandin injections.

Overall, this herd is very typical of many western dairies with an average pregnancy rate of 15%. The apparent insemination risk is 54%, but this figure is for the whole herd. To determine the number for AI only, one must exclude information from the bull pens. Repeating the above command but excluding the "A" from the command line shows that the average insemination risk is 59%. Estimates from across the U.S. suggest that typical numbers for pregnancy rate are in the range of 14-15%, but well managed dairies can achieve pregnancy rates in the mid-20's, thus, capturing most of the economic value associated with reproductive performance improvement.[5]

To focus in more specifically on the herd's reproductive performance using pregnancy rate over specific time periods, one can tweak the command line to limit it to only AI breedings and to evaluate the pregnancy rate by DIM (or by days since the VWP) as shown in figure 8. In it one can see that this high producing Holstein herd is performing quite well with an annual pregnancy rate of 25% for the AI herd. Although not shown, the whole herd pregnancy rate including the limited number of bull breedings is still a respectable 24% for the year. Figure 9 displays another version of the same information, obtained by clicking on the graph tab below the pregnancy rate report.

Figure 8. Pregnancy rate by DIM for a large western dairy that utilizes TAI for ~ 30% of its breeding management. (Note: several cycles have been omitted to reduce the printed space required)

DIM	Br Elig	Bred	Pct	Pg Elig	Preg	Pct	Aborts
50	1561	750	48	1541	311	20	39
71	1212	1045	86	1176	467	40	56
92	684	380	56	670	135	20	22
113	520	370	71	509	120	24	8
134	393	227	58	386	75	19	7
155	316	201	64	313	63	20	7
176	236	146	62	233	54	23	6
197	169	97	57	163	24	15	5
218	123	72	59	119	23	19	3
239	86	56	65	79	14	18	0
260	52	32	62	50	10	20	1
*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*
785	1	0	0	1	0	0	0
806	1	0	0	1	0	0	0
827	1	0	0	1	0	0	0
Total	5420	3404	63	5304	1304	25	156

Figure 9. Graphical display of the actuarial survival curve depicted by the same pregnancy rate results shown in figure 8.

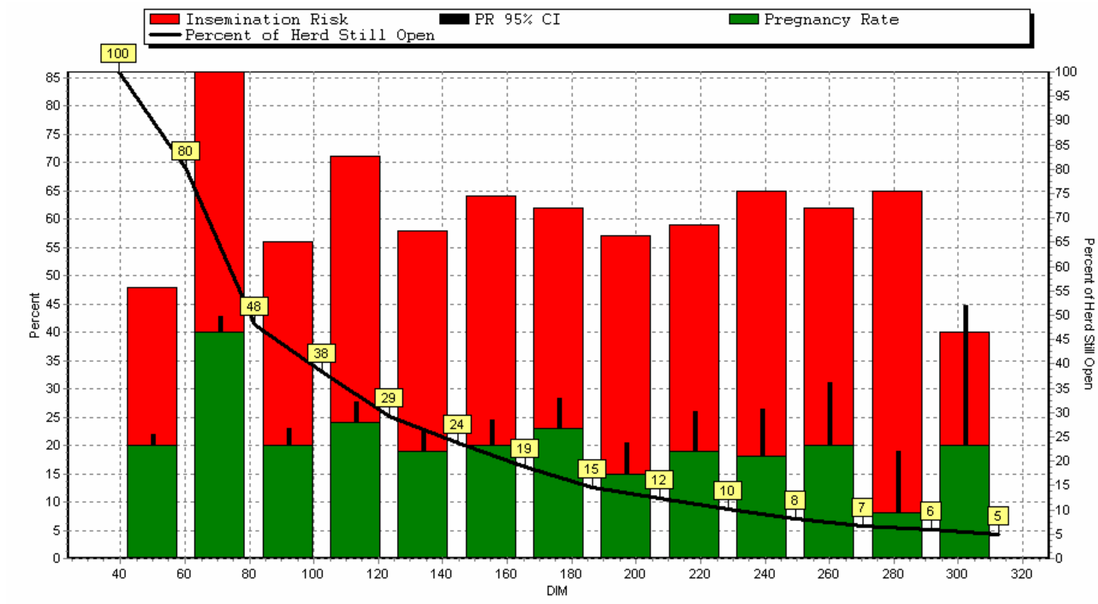


Figure 9 represents several different important results. First, it illustrates the breeding submission risk and pregnancy rate over each of the 21-d time period, starting at 50 DIM. The black line running through it illustrates the actuarial survival curve analysis of the same data. Essentially, it is demonstrating the change in proportion of cows remaining non-pregnant at the end of each 21-d cycle. Two important points can be made from this graph. First, this herd appears to be getting 52% of the cows pregnant within 2 21-d breeding cycles. Second, by 300 DIM, if all cows follow the same pattern, there will only be ~ 5% remaining non-pregnant.

Although this approach to using Bredsum is interesting, one must use a bit of caution when using it. We are looking at performance over time in 21-d cycles, but the cows included in it have a wide range of DIM and thus these types of analysis have huge momentum issues.

There are additional ways of evaluating pregnancy rate within DC305 including stratification by parity (first vs. older cows, for example), evaluation of bull performance by calendar date, and evaluation of bull performance by days with the bull. I have spent considerable time evaluating bull reproductive performance and working to help herds improve the performance of their natural service sires. However, if bull pens are not correctly identified or if actual move dates are not recorded, evaluation of their performance is not possible. If these details are managed correctly, producers and consultants can evaluate the performance of "clean-up" bulls using pregnancy rate and commands that are similar to those previously mentioned. For example, to evaluate how well (or in most cases, how poorly) bulls are performing, one can use the following command: BREDSUM\UR. This command will create an estimate of pregnancy rate for cows with bulls, not by calendar date, but rather by days with the bull. Many people feel that bulls often get lower fertility cows. While this may indeed be true to varying degrees, one would still expect the pregnancy rate within the first 1-2 21-d cycles with the bulls to be very good. However, this is often not the case and previously published work has demonstrated that AI usually outperforms bull breeding in large Western dairies and most dairies would benefit by giving cows additional exposure time to well managed AI programs.[7]

When investigating or monitoring reproductive performance in AI herds, one should look not only at the effect that insemination risk has on pregnancy rate but also on the conception risk per insemination. BREDSUM\B provides the overall conception risk over the last year, stratified by service number. If the herd is recording different breeding approaches such as Ovsynch using breeding codes, BREDSUM\O is useful to compare conception risk performance for these breedings vs. ordinary heat detection-based breedings. (If the herd is not currently utilizing the breeding codes function, I would work with the herd manager to incorporate this recording approach to improve future evaluation capabilities.) Depending on the herd size, I like to stratify the conception risk results into 2 variables such as by times bred and by breeding code to determine how TAI is performing relative to heat detection or by times bred and technician to compare technicians on a dairy. Do not dwell specifically on conception risk, per se since the bottom line is pregnancy rate. Some herds may have excellent conception risk but do not breed enough cows to achieve adequate pregnancy rates. Conception risk must be interpreted together with insemination risk and pregnancy rate.

Concerns Regarding the Comparison of Conception Risk Between Groups

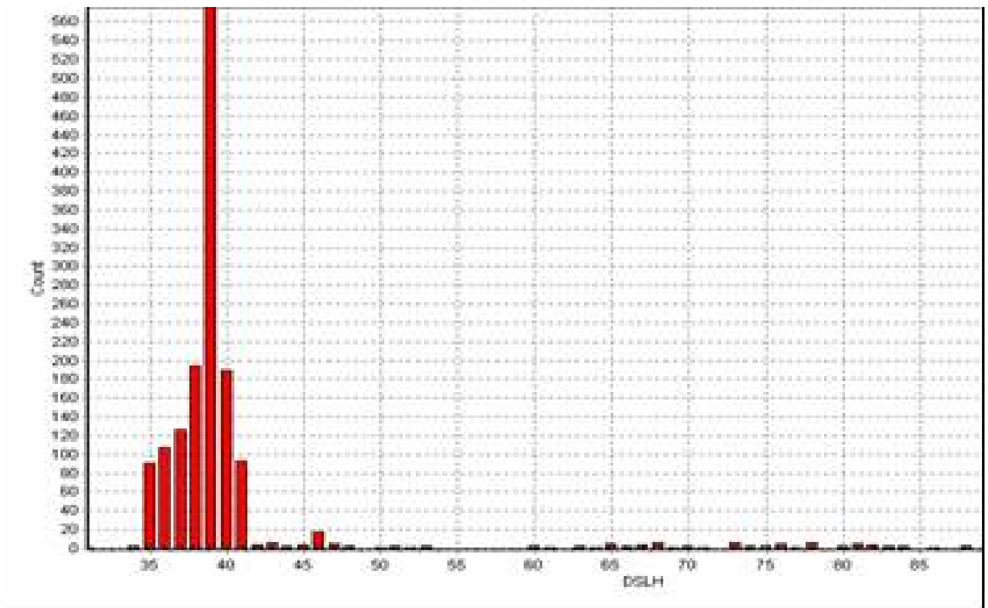
However, a few words of caution are needed regarding conception risk and interpretation. In many herds in the U.S., there are often insufficient numbers of inseminations to adequately and correctly draw statistically correct conclusions about conception risk once it is stratified by lactation, times bred, technician, etc. I have heard stories of dairy managers changing insemination technicians based on a 7-8% difference in apparent conception risk. Statistically speaking, in order to have full confidence (95%) that the differences are indeed real, there must be ~ 750 cows per breeding group in order to confidently say that 42% CR by technician 1 is indeed different than the 35% CR by technician 2. Also, make sure that if sufficient numbers are available, that you are comparing apples to apples and not apples to oranges. For example, if I want to compare the performance of the aforementioned technicians, I must make sure that they are actually breeding the same types of cows (first lactation, for example) and that one is not cherry picking certain cows. How many herds do you know that have enough first lactation animals that are bred for the first time during the summer heat stress period to make up two groups of 750+ animals each? In reality, this is very difficult to achieve, and while few herds are interested in the 95% confidence interval prior to making a change, the point is made that caution should be observed prior to firing someone that may in fact be doing a reasonable job.

Also, if a new technician is hired, there must be sufficient time elapsed before an evaluation is possible. Conception risk is determined using inseminations with known outcomes. Whenever a new technician starts, his or her early conception risk numbers are biased downward since you gain information about negative outcomes (conception failure) earlier via cows returning to heat than positive outcomes (pregnancies) due to differences in the lag time for outcome determination.

Process Monitoring

Another area that I like to review is the pregnancy check schedule. Most large dairy herds have pregnancy evaluation performed once a week or once every other week. A simple command (GRAPH PREG BY DSLH\N1) reveals the historical information regarding when the pregnant cows were actually evaluated for pregnancy for the first time. In the herd pictured in figure 10, it is very evident that herd checks are done once weekly (7-day intervals), the first exam is performed at 35 days post-breeding, and that a majority of cows are evaluated for pregnancy at 39 days post-breeding (indicating TAI). In addition, there are very few cows that are recorded as pregnant for the first time past 41 days. Without any knowledge of the herd, there are a couple of options that strike me as possibilities. First, these late checks could be from cows that are moved into bull pens and later found pregnant there, either to previous AI breedings or to the bulls. Another possibility would be poor compliance regarding the presentation of cows to the veterinarian for evaluation. The smaller spike at 46 days most likely is the result of cows classified as “rechecks”, where the actual determination is postponed for 1 week.

Figure 10. Days since last heat (days carried calf) at pregnancy evaluation for herd “B”.



An alternative reproductive monitoring approach that has gained in popularity is the concept of pregnancy hard counts or pregnancy inventory. The basis for this approach is that in order for a herd to maintain itself in cow numbers, a minimum number of calvings per month is necessary to replace cows that are culled, sold, or that may die. For most non-seasonal, stable herds (not expanding or contracting in size) with typical culling risks, approximately 10% of the cow herd should calve each month. This estimate can be derived by dividing the total cow herd inventory (milking and dry) by the actual calving interval. For example, in a herd with 1600 total cows and a 13.5 actual calving interval, ~ 120 calvings per month are needed. In order to end up with 120 calvings, we must account for the culling of pregnant cows and the pregnancy loss. If 10% of pregnancies are lost to abortion and 2% of pregnant cows are culled, we must adjust by a total of 12%. In this case, 120/ (1-.12) = 136 pregnancies must be created per month, including heifer replacements and lactating cows. If the culling risk for the lactating herd is 33%, then the herd must provide 33% of the pregnancies by heifer replacements and the rest by the milking cow herd, resulting in ~ 91 pregnancies needed from the cow herd per month to maintain a stable herd size, or about 21 pregnancies per week. In order to create 21 pregnancies per week in a herd with a conception risk of 30%, about 70 cows should be inseminated per week. Some farms have found that pregnancy hard counts use in this manner may be beneficial as a longer term goal to help address the roller coaster calving patterns that are often found (and the resulting strain that these patterns may place on transition cow facilities and management).

Unfortunately, there are a number of weaknesses with this approach. First, it does not consider the number of eligible cows. It is rare to find a herd with a stable number of non-pregnant cows year-round. Second, it sometimes provides inseminators the assumption that we must breed "X" number of cows this week, irrespective of the population at risk for breeding. Third, this number ignores the impact of early pregnancy diagnosis, and pregnancy wastage. Pregnancy rate is a superior monitor.

Another facet of reproductive management that must not be forgotten is the problem of pregnancy wastage and its potential impact on reproductive efficiency. Pregnancies that are lost prior to ~ day 40 post-breeding are termed embryonic loss and losses that occur after day 40 are termed abortions. A herd's apparent conception risk can look better or worse depending upon how early pregnancy diagnosis is conducted. For herds utilizing ultrasound and recording early pregnancy outcomes, the apparent conception risk (and pregnancy rates and counts) as well as risk of pregnancy loss could potentially be falsely elevated depending upon how these early results are handled by the software program and by the nomenclature used by the farm. Perhaps we should only utilize early exams with ultrasound or blood testing as "open" cow checks and reserve the pregnancy check for closer to 40 days post-breeding.

Calculating abortion risk in a dairy herd is often a tremendous challenge, even without the early diagnosis issues. Notice in this case the term is abortion risk. In order to actually calculate the true abortion rate over time, we must know exactly when the pregnancy was lost. Virtually no herds know when pregnancies are actually lost and often there is a clustering of abortions around the time of pregnancy reconfirmation. The records usually reflect when the cow was determined to be "not pregnant" anymore and a guess is made as to when the abortion actually occurred.

Another issue plaguing the calculation of abortion risk is that cows must have a full gestation time at risk. The risk of pregnancy loss is greatest during the earliest parts of pregnancy and sharply decreases over the lifetime of the pregnancy. DC305 has made the task of abortion risk much easier with their approach to reporting abortions by when the pregnancy was actually created and this information appears on the standard Bredsum report. Calculation of a correct, historical abortion risk is relatively easily performed if one has the full archive data set. In DC305, this calculation is performed by using the following approach:

1) type BREDSUM\EAD and hit enter
2) type in the date as of 20 months ago and hit enter
3) type in the date as of 8 months ago and hit enter
4) divide the total abortions by the total pregnancies created

Of course, an astute observer will realize that the problem with this approach is the tremendous lag that is present. While this approach will give a good approximation of the true average annual abortion risk, it is always 14 months old in order to allow for both the years worth of data and a full gestation at risk for each cow. Repeating the above process but only looking at the most recent year will give some indication of the true risk, but it usually biases the abortion risk downward (or underestimates the true risk). In my experience, the latter approach typically yields an estimate that is 2-5 % points lower than the previous approach and care should be taken with interpretation. There are pregnant cows that will abort, but have not yet been counted.

The final area for consideration when evaluating reproductive performance should probably be the first area considered after verifying that the records are complete. This critical area is transition cow management. In order to obtain high pregnancy rates, herds must do an excellent job of transitioning cows from far dry to lactating. Care should be taken to minimize the risk of an assortment of periparturient diseases such as milk fever, metritis, displaced abomasums, ketosis, etc. Unfortunately, this is an area that is most inconsistently recorded across farms. Farms need to emphasize the accurate recording of the major transition disorders. Without these data, advisors or consultants erroneously look at things like early lactating culling risk as proxies for transition management. Most commonly, culling risk is expressed as the percent of calvings that leave the herd due to death or sale in the first 30 or 60 DIM with goals often stated of < 4-5% and < 2%, respectively. However, again we have the issue of lag here and trying to manage by looking into the past. Furthermore, these measures encourage employees to keep unprofitable cows until after 30 or 60 days instead of promptly replacing them.

A better and far more sensitive indicator of overall transition success that could be readily and easily used might be to record the risk of key transition problems such as retained placenta, metritis, and displaced abomasums. Furthermore, having accurate disease data should also encourage the use of consistent treatment protocols, which will help with hospital group management.   However, in many cases, this information is not comparable across herds, especially in the case of metritis, due to different disease definitions used and due to issues regarding detection bias. Due to the interrelationship of retained placenta, immune function, and metritis, a compromise for me would be to have all herds record the occurrence of retained placentas. In this case, the definition would be that of a fetal membrane retained for 24 hours or more and hopefully, most herds could accomplish this simple chore just by careful visual evaluation of each cow 24 hrs after calving.

Monitoring dairy herd reproductive performance need not be a complicated, daunting task, but a little preparation can ensure that the correct performance indicators are used correctly. Of course, this may mean changing the monitoring parameters that have been used in the past. Short (low) calving intervals and reduced days-open are legitimate goals for dairies, but these outcomes should not be used as key monitoring parameters due to the previously mentioned problems such as lag, momentum, bias and variation. Instead, focus on a few key areas such as first service insemination efficiency, re-insemination of non-pregnant cows in a timely manner, optimizing rather than maximizing conception risk, and transitioning cows in a healthy manner. With an eye on these key areas, carefully maintained and accurate records that can be analyzed appropriately can determine historical reproductive performance, current status of pregnancy generation, and may help give some guidance to where the dairy is headed in the near future. Although there is no one perfect reproductive parameter, whole herd pregnancy rate, when calculated and used correctly, provides the most information regarding overall performance and should be the basis for evaluating dairy herd reproductive efficiency.

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